8-1-2016

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Recommended Citation

Puls, H. T., Hall, M., Bettenhausen, J. L., Johnson, M. B., Peacock, C., Raphael, J. L., Newland, J. G., Colvin, J. D. Failure to Thrive Hospitalizations and Risk Factors for Readmission to Children's Hospitals. *Hosp Pediatr* 6, 468-475 (2016).

RESEARCH ARTICLE

Failure to Thrive Hospitalizations and Risk Factors for Readmission to Children's Hospitals

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ABSTRACT

OBJECTIVES: Risk factors for failure to thrive (FTT) readmissions, including medical complexity, have not been described. We sought to characterize children hospitalized for FTT and identify risk factors associated with FTT-specific readmissions during the current era of increasing medical complexity among hospitalized children.

METHODS: This retrospective cohort study used the Pediatric Health Information System database of 43 freestanding children's hospitals across the United States. The cohort included children <2 years of age with index hospitalizations for FTT between 2006 and 2010. The main outcome was FTT-specific readmission within 3 years. Using Cox proportional hazards models, we assessed the association of demographic, clinical, diagnostic, and treatment characteristics with FTT-specific readmission.

RESULTS: There were 10 499 FTT hospitalizations, with 14.1% being readmitted for FTT within 3 years and 4.8% within 30 days. Median time to readmission was 66 days (interquartile range, 19–194 days). Nearly one-half of children (40.8%) had at least 1 complex chronic condition (CCC), with 16.4% having ≥2 CCCs. After multivariable modeling, increasing age at admission, median household income in the lowest quartile (adjusted hazard ratio, 1.23 [95% confidence interval, 1.05–1.44]), and prematurity-related CCC (adjusted hazard ratio, 1.46 [95% confidence interval, 1.16–1.86]) remained significantly associated with readmission.

CONCLUSIONS: Nearly one-half of children hospitalized for FTT had a CCC, and a majority of FTT-specific readmissions occurred after the traditional 30-day window. Children with prematurity-related conditions and low median household income represent unique populations at risk for FTT readmissions.

www.hospitalpediatrics.org
DOI:10.1542/hpeds.2015-0248

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HOSPITAL PEDIATRICS (ISSN Numbers: Print, 2154-1663; Online, 2154-1671).

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: No external funding.

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

The manuscript's first draft was written by Drs Puls, Bettenhausen, Johnson, and Peacock. Dr Puls participated in the study design, interpretation of data, drafting of the manuscript, and critical revision of the manuscript, and was the primary author of the manuscript; Dr Hall participated in the study design, acquisition and analysis of data, interpretation of data, and critical revision of the manuscript; Drs Bettenhausen, Johnson, and Peacock participated in the study design, interpretation of data, drafting of the manuscript, and critical revision of the manuscript; Drs Raphael and Newland participated in the interpretation of data and critical revision of the manuscript; and Dr Colvin participated in the study design, interpretation of data, and critical revision of the manuscript. All authors have seen, approved, and take full responsibility of the submitted version of the manuscript.

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Failure to thrive (FTT) and malnutrition remain prevalent problems within both the general and the hospitalized pediatric populations.[1,2] The identification and management of FTT remain crucial given their association with adverse outcomes, including decreased cognition, learning difficulties, and behavior disturbances.[3–5]

Few studies since the 1970s have investigated inpatient-based FTT. Since that time, the number of children with medical complexity and technology dependence has dramatically risen and account for an increasing number of admissions, readmissions, hospital days, and charges.[6,7] This increasing prevalence of complexity among hospitalized children often correlates with more complex feeding needs and deviations in normal growth patterns. These factors may impact the inpatient-based care of FTT, having important implications for the diagnostic evaluation and treatment of these children. In addition, some etiologies of FTT may prove to be chronic, particularly among children with medical complexity. Due to this changing epidemiology of hospitalized children (especially the increase in children with medical complexity), more current data are needed. Finally, given that approximately one-half of FTT readmissions are estimated to be potentially preventable, with an estimated annual cost of $6.9 million,[8] understanding the factors associated with readmission, a marker for refractory illness and quality of care, may be important.

The goal of the present study was to describe the characteristics of children hospitalized for FTT during the current era of increasing medical complexity among hospitalized children[6,7] and to identify risk factors associated with FTT-specific readmission. We hypothesized that children with medical complexity would account for a large portion of those hospitalized for FTT and would be associated with an increased risk for readmission. To investigate, a retrospective cohort study was conducted of children hospitalized for FTT at 43 freestanding children's hospitals.

METHODS

Data Source

The Pediatric Health Information System (PHIS) is a comprehensive pediatric database managed by the Children's Hospital Association (Overland Park, KS). It contains administrative and financial data for all in-hospital admissions at 43 freestanding children's hospitals in the United States. PHIS contains up to 41 *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM), diagnosis codes and 41 ICD-9-CM procedure codes per admission. Patient demographic characteristics and charges for procedures, radiographic studies, medications, and feeding modalities were also collected for the index hospitalization. A unique patient identifier permits longitudinal tracking of individual patients readmitted to the same PHIS hospital. This study was deemed exempt by the institutional review board at Children's Mercy Hospital (Kansas City, MO).

Study Population

Inclusion criteria were children <2 years of age admitted to a PHIS hospital from 2006 to 2010 with a primary discharge diagnosis of the following: failure to thrive in the newborn (779.34), failure to thrive in a child over 28 days (783.41), abnormal loss of weight (783.21), or underweight (783.22). Exclusion criteria included children with intensive care charges, in-hospital mortality during the index hospitalization, and any previous admission for FTT. These exclusion criteria were selected to identify a unique cohort of patients with FTT and to exclude severity of illness not typically representative of isolated FTT.

Outcome Measures

The primary outcome was FTT-specific readmission (ie, having a primary discharge diagnosis of FTT for the readmission encounter) within 3 years of the index FTT hospitalization. Given that, to the best of our knowledge, the time to readmission for FTT has not previously been investigated, a longer, 3-year window for readmission was selected for this study to account for the potentially longitudinal nature of FTT and the chronic nature of any concurrent complex chronic conditions (CCC). A more traditional 30-day FTT-specific readmission rate was also calculated to allow comparison with other diseases previously studied using 30-day readmission rates. All-cause readmission rates were also evaluated for 30-day and 3-year windows. Costs for the index hospitalization were also assessed. In PHIS, costs are estimated from charges by using hospital-specific cost-to-charge ratios and adjusted for the hospital's location by using the price/wage index of the Centers for Medicare & Medicaid Services.

Predictor Variables

Predictor variables for demographic characteristics, clinical factors, procedures, diagnostics, treatments, and feeding modalities were collected for the index FTT encounter. Demographic predictor variables included age at index hospitalization, sex, race/ethnicity, payer, and quartile of median household income (HHI) of the patient's home zip code. Clinical predictor variables included length of stay (LOS) and CCC, as well as conditions that have previously been shown to be prevalent in children hospitalized with FTT (abuse/neglect, gastroesophageal reflux [GERD], feeding problems, and dysphagia).[9,10] Children with medical complexity were identified as those with a CCC, which has been defined as "any medical condition that can be reasonably expected to last at least 12 months (unless death intervenes) and to involve either several different organ systems or 1 organ system severely enough to require specialty pediatric care and probably some period of hospitalization in a tertiary care center."[11] Examples of CCC include but are not limited to inflammatory bowel disease, spinal muscular atrophy, and chromosomal abnormalities such as trisomy syndromes. The second version of the pediatric CCC classification system was used to define and identify CCC cases. Quartile of median HHI of the patient's home zip code was used as a proxy for socioeconomic status.[12] Due to a low number of patients receiving jejunal feeds patients with nasojejunal feeding tubes were analyzed with nasogastric patients, nasogastric/nasojejunal (NG/NJ), and patients with jejunostomies were analyzed with gastrostomy patients,

gastrostomy/jejunostomy (G/J). To ensure that feeding categories were mutually exclusive, feeding was treated as a single variable with 3 categories: oral, NG/NJ, and G/J. A full list of covariables assessed and the ICD-9-CM and Clinical Transaction Classification codes used to define them are available in Supplemental Table 4.

Statistical Analysis

Frequencies of readmission were calculated at 3 years from the index FTT hospitalization. The χ^2 tests were used to compare the rates of readmission for each predictor variable. Multivariable time-to-event analyses with Cox proportional hazards models were built to assess patient-level predictors of readmission. To adjust for clustering of patients within hospitals, all models were clustered on hospital using hospital as a random effect. Adjusted hazard ratios were used to report the odds of readmission and to describe the instantaneous relative risk of readmission based on comparison of event rates between 2 populations.[13,14] Only covariates with a *P* value <.1 in bivariate analyses were used in the models. For selected variables of inerest, survival curves were generated by using the Kaplan-Meier approach, and the log-rank statistic was used to assess variation in survival across strata. All statistical analyses were performed by using SAS version 9.3 (SAS Institute, Inc, Cary, NC) with a *P* value <.05 being considered statistically significant.

RESULTS

Cohort and Index Admission Characteristics

The cohort included 10 499 patients with index hospitalizations for FTT. Patients were most commonly non-Hispanic white, male, had government insurance, were 2 to 6 months of age, and had a median LOS of 4 days (interquartile range, 2–6 days) (Table 1). The greatest proportion of FTT hospitalizations were from the lowest quartile of HHI. Nearly one-half of children (40.8%) had at least 1 CCC, with 16.4% of the cohort having ≥2 CCCs. Gastrointestinal, technology dependent, congenital/genetic, neurologic/neuromuscular, and cardiovascular were the 5 most prevalent

TABLE 1 Patient Demographic and Clinical Characteristics of Index FTT Hospitalization

Characteristic	Overall (*n* = 10 499)	Not Readmitted (*n* = 9016 [85.9%])	Readmitted[a] (*n* = 1483 [14.1%])	*P*
Male sex	5505 (52.4)	4740 (86.1)	765 (13.9)	.48
Age, mo				<.001
0–1	1979 (18.8)	1772 (89.5)	207 (10.5)	
2–6	3631 (34.6)	3126 (86.1)	505 (13.9)	
7–12	2521 (24.0)	2121 (84.1)	400 (15.9)	
13–24	2368 (22.6)	1997 (84.3)	371 (15.7)	
Race				.08
Non-Hispanic white	5684 (54.1)	4880 (85.9)	804 (14.1)	
Non-Hispanic black	2401 (22.9)	2035 (84.8)	366 (15.2)	
Hispanic	1231 (11.7)	1081 (87.8)	150 (12.2)	
Asian	196 (1.9)	163 (83.2)	33 (16.8)	
Other	987 (9.4)	857 (86.8)	130 (13.2)	
Payer				.41
Government	6509 (62.0)	5595 (86.0)	914 (14.0)	
Private	2915 (27.8)	2512 (86.2)	403 (13.8)	
Other	1075 (10.2)	909 (84.6)	166 (15.4)	
Median HHI[b]				.05
Lowest	3218 (31.4)	2719 (84.5)	499 (15.5)	
Below average	2629 (25.7)	2280 (86.7)	349 (13.3)	
Above average	2437 (23.8)	2096 (86.0)	341 (14.0)	
Highest	1957 (19.1)	1696 (86.7)	261 (13.3)	
LOS,[c]				<.001
1–2	2754 (26.2)	2398 (87.1)	356 (12.9)	
3–6	5187 (49.4)	4516 (87.1)	671 (12.9)	
≥7	2558 (24.4)	2102 (82.2)	456 (17.8)	
CCC present	4282 (40.8)	3580 (83.6)	702 (16.4)	<.001
No. of CCC				<.001
0	6223 (59.3)	5441 (87.4)	782 (12.6)	
1	2558 (24.4)	2110 (82.5)	448 (17.5)	
2	1213 (11.6)	1021 (84.2)	192 (15.8)	
3	422 (4.0)	369 (87.4)	53 (12.6)	
≥4	83 (0.8)	75 (90.4)	8 (9.6)	
CCC category[d]				
Neurologic/neuromuscular	955 (9.1)	790 (82.7)	165 (17.3)	.003
Cardiovascular	878 (8.4)	758 (86.3)	120 (13.7)	.68
Respiratory	504 (4.8)	414 (82.1)	90 (17.9)	.01
Renal/urologic	270 (2.6)	223 (82.6)	47 (17.4)	.12
Gastrointestinal	2028 (19.3)	1764 (87.0)	264 (13.0)	.11
Hematologic/immunologic	207 (2.0)	173 (83.6)	34 (16.4)	.34
Metabolic	337 (3.2)	275 (81.6)	62 (18.4)	.02
Congenital/genetic	965 (9.2)	819 (84.9)	146 (15.1)	.35
Malignancy	95 (0.9)	78 (82.1)	17 (17.9)	.29
Premature/neonatal	359 (3.4)	280 (78.0)	79 (22.0)	<.001
Technology dependent	1996 (19.0)	1722 (86.3)	274 (13.7)	.57
Transplant	40 (0.4)	36 (90.0)	4 (10.0)	.45

TABLE 1 Continued

Characteristic	Overall (n = 10 499)	Not Readmitted (n = 9016 [85.9%])	Readmitted[a] (n = 1483 [14.1%])	P
Other comorbidities[c]				
Abuse or neglect	24 (0.2)	23 (95.8)	1 (4.2)	.16
GERD	3999 (38.1)	3347 (83.7)	652 (16.3)	<.001
Feeding problem	2578 (24.6)	2150 (83.4)	428 (16.6)	<.001
Dysphagia	480 (4.6)	397 (82.7)	83 (17.3)	.04

Data are presented as n (%).
[a] FTT-specific readmission within 3 years from an index hospitalization with a primary discharge diagnosis for FTT.
[b] Median HHI based on zip code of residence, reported in quartiles.
[c] Other comorbidities identified by using ICD-9-CM codes as defined in Supplemental Table 4.
[d] CCC categories identified by using ICD-9-CM codes as defined by Feudtner et al.[11]

CCC categories. GERD and feeding problems were each individually present in nearly one-third of the cohort. Concurrent coding for child abuse or neglect was rare. The majority of children were fed orally, whereas approximately one-fourth were fed by either NG/NJ or G/J tube (Table 2). The average cost of the index hospitalization was $436 higher for patients subsequently readmitted.

Readmission Rates

Overall, 14.1% of patients had a FTT-specific readmission within 3 years of their index hospitalization. The 30-day FTT-specific readmission rate was 4.8%. The median time to the first FTT-specific readmission was 66 days (interquartile range, 19–194 days), and 73% occurred within 6 months (Fig 1). The all-cause 3-year readmission rate was 39.5%, with 31.7% having a primary diagnosis of FTT and 40.3% having a secondary diagnosis of FTT. The all-cause 30-day readmission rate was 14.5%, with 33.0% having a primary diagnosis of FTT and 43.5% having FTT as a secondary diagnosis.

TABLE 2 Unadjusted Data for Diagnostics, Treatments, and Feeding Modalities During Index FTT Hospitalization

Covariable	Overall	Not Readmitted	Readmitted[a]	P
Diagnostics[b]				
Endoscopy	863 (8.2)	695 (80.5)	168 (19.5)	<.001
Swallow study	216 (2.1)	166 (76.9)	50 (23.1)	<.001
Brain MRI	832 (7.9)	673 (80.9)	159 (19.1)	<.001
Treatments[b]				
Fundoplication	100 (1.0)	92 (92.0)	8 (8.0)	.08
Central line	157 (1.5)	124 (79.0)	33 (21.0)	.01
Histamine antagonists	2487 (23.7)	2082 (83.7)	405 (16.3)	<.001
Proton pump inhibitors	3014 (28.7)	2500 (82.9)	514 (17.1)	<.001
Promotility drugs	1003 (9.6)	836 (83.3)	167 (16.7)	.02
Feeding modalities[b]				<.001
G/J tube	1800 (17.1)	1568 (87.1)	232 (12.9)	
NG/NJ tube	965 (9.2)	755 (78.2)	210 (21.8)	
Oral	7734 (73.7)	6693 (86.5)	1041 (13.5)	
Parenteral nutrition[b]	217 (2.1)	180 (82.9)	37 (17.1)	.21
Total costs (minimum–maximum)[c]	5146.9 (3075.2–8746.6)	5106.1 (3070.2–8581.4)	5541.8 (3125.1–10 286.4)	<.001

Data are presented as n (%) unless otherwise indicated.
[a] FTT-specific readmission within 3 years from an index hospitalization with a primary discharge diagnosis for FTT.
[b] Covariables identified by using ICD-9-CM codes as defined in Supplemental Table 4.
[c] Costs reported as each hospital's cost-to-charge ratio.

Unadjusted Associations With 3-Year FTT-Specific Readmissions

Older age, lowest HHI, and longer LOS were associated with FTT-specific readmission (Table 1). Patients with any CCC had a higher rate of FTT-specific readmission at 3 years compared with those without a CCC, although risk for readmission decreased with an increasing number of CCCs. Respiratory, neurologic/neuromuscular, prematurity, and metabolic CCCs, as well as concurrent diagnoses of GERD and feeding problems, were associated with readmission at 3 years. NG/NJ feeding and having a central line were associated with increased risk for readmission, whereas having a G/J tube or receiving parenteral nutrition during the index admission were not (Table 2). Of the 965 children receiving NG/NJ-delivered nutrition during their index admission, 210 (21.8%) were readmitted. Of those 210 readmitted, in addition to a primary FTT-specific discharge code, 118 (56.2%) received a gastrostomy procedure code during their readmission.

Multivariable Analysis of 3-Year FTT-Specific Readmissions

After adjusting for comorbid conditions as well as demographic, diagnostic, therapeutic, and other characteristics of the index FTT admission (Table 3), older age at the index hospitalization, lowest HHI quartile, and prematurity-related CCCs continued to be risk factors for FTT-specific readmission. NG/NJ tube feedings had the highest risk for FTT-specific readmission among therapy-related factors. In contrast, G/J feedings were associated with decreased readmissions.

DISCUSSION

This study found that the characteristics of children hospitalized for FTT have changed in recent decades, with nearly one-half having a CCC. Given the increased likelihood of readmission for children with CCCs,[15] it is interesting that prematurity-related CCC

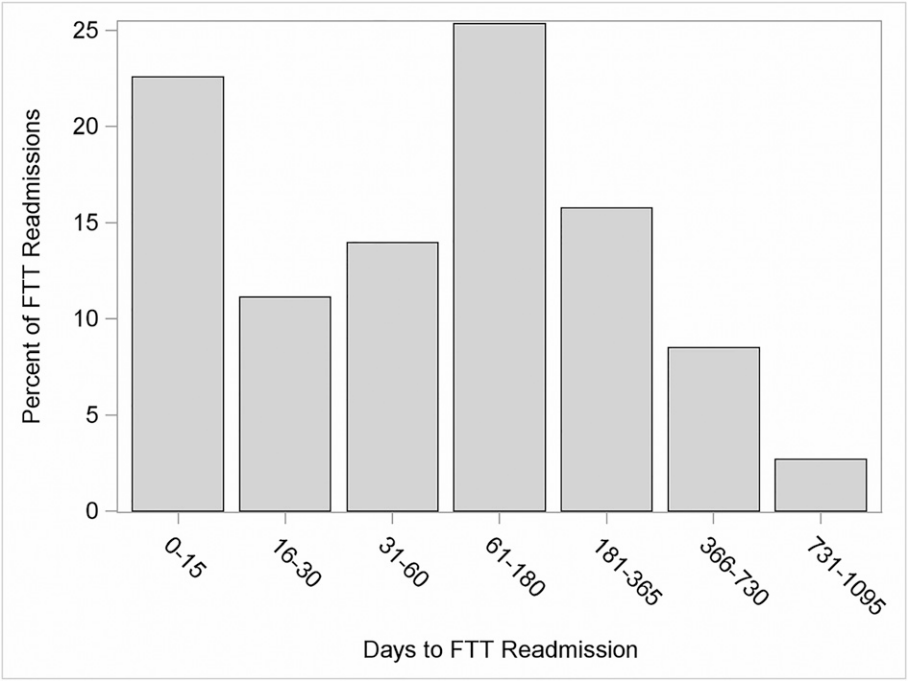

FIGURE 1 Distribution of days to first FTT readmission within 3 years.

was the only category that remained associated with readmission after multivariable modeling. This CCC category principally includes cases of extreme prematurity, intraventricular hemorrhage, asphyxia at birth, and hypoxic-ischemic encephalopathy.[11] Approximately 14% of children hospitalized for FTT experienced an FTT-specific readmission within 3 years, nearly three-fourths of which occurred within 6 months of their discharge. It is important to note, however, if only considering traditional ≤30-day readmission windows for FTT, approximately two-thirds of FTT-specific readmissions will not be captured. Older age at the index hospitalization and low HHI were risk factors for FTT-specific readmission. Finally, patients with more permanent feeding modalities such as G/J tubes, compared with temporary modalities such as NG/NJ tubes, were less likely to be readmitted.

Postnatal growth failure among premature infants is common[16,17] and associated with adverse neurodevelopmental outcomes.[18] The association of prematurity-related CCC with readmission in this study is in agreement with these high rates of growth failure among premature infants. Data on which factors, including clinical comorbidities, that may be most predictive of postnatal growth failure have been inconsistent.[16,17] In addition to this study's findings, variation in growth outcomes of premature infants between institutions[16] suggests that optimizing postnatal growth during both the neonatal and postneonatal periods are areas for future quality improvement initiatives.

The present study's 30-day FTT-specific readmission rate (4.8%) is comparable to those found in other pediatric-specific conditions such as pneumonia (3.1%), bronchiolitis (6.4%), and diabetic ketoacidosis (2.5%).[19–21] The 3-year and 30-day all-cause readmission rates (39.5% and 14.5%, respectively) are not unexpected given that malnutrition has been shown to be associated with increases in hospitalization rates, LOS, and mortality.[22–24] In addition, nearly one-half of our cohort included children with a CCC, a group known to have an elevated risk for 30-day all-cause readmission (25.4%)[15] over that of the general pediatric population (6.5%).[25] Older age at the time of hospitalization was associated with readmission in this study. Intuitively, this finding seems accurate given that hospitalization is often relied upon only after outpatient-based therapies have been attempted and found to be unsuccessful.[26]

A few of the present study's findings contrast with previous research. First, although previous population-based evidence has not supported an association between socioeconomic status and FTT prevalence,[27,28] our findings indicate that low-income children are at increased risk for FTT readmission. Similarly, there is evidence that HHI is a risk factor for readmission for other but not all conditions.[20,21,29] Although socioeconomic status may not be associated with FTT on a population level, previous evidence has shown that food insecurity (a marker of poverty) is associated with poorer health outcomes, possibly explaining the relationship between low HHI and FTT readmission.[30,31] Second, for patients with more permanent feeding modalities such as G/J tubes, this study found a reduced risk for readmission compared with temporary modalities such as NG/NJ tubes. In contrast, Sharma et al,[32] with a sample size of 41 patients, detected no difference in admission rates between early or late gastrostomy placement during both

TABLE 3 Adjusted Hazard Ratios With 95% CIs for Time to FTT Readmission Within 3 Years

Characteristic	Adjusted Hazard Ratio[a] (95% CI)	*P*
Age, mo		
0–1	Ref	
2–6	1.26 (1.06–1.48)	.01
7–12	1.43 (1.19–1.70)	<.001
13–24	1.50 (1.25–1.79)	<.001
Median HHI[b]		
Lowest	1.23 (1.05–1.44)	.01
Below average	0.98 (0.83–1.15)	.79
Above average	1.06 (0.90–1.25)	.47
Highest	Ref	
LOS, d		
1–2	Ref	
3–6	0.92 (0.81–1.05)	.23
≥7	1.16 (0.99–1.35)	.06
Prematurity CCC[c]		
No	Ref	
Yes	1.46 (1.16–1.86)	.002
Feeding problems[d]		
No	Ref	
Yes	1.17 (1.04–1.32)	.01
Endoscopy[d]		
No	Ref	
Yes	1.21 (1.01–1.43)	.03
Swallow study[d]		
No	Ref	
Yes	1.63 (1.20–2.21)	.002
Brain MRI[d]		
No	Ref	
Yes	1.28 (1.08–1.52)	.005
Feeding		
Oral[e]	Ref	
G/J tube[d]	0.72 (0.61–0.84)	<.001
NG/NJ tube[d]	1.41 (1.19–1.67)	<.001
Histamine antagonists[d]		
No	Ref	
Yes	1.20 (1.06–1.35)	.003
Proton pump inhibitors[d]		
No	Ref	
Yes	1.20 (1.06–1.35)	.003

CI, confidence interval.

[a] Adjusted for age, race, median HHI, LOS, dysphagia, feeding problems, GERD, metabolic CCC, prematurity CCC, neuromuscular CCC, respiratory CCC, NG/NJ feeding, G/J feeding, endoscopy, abdominal radiograph, brain MRI, central line, fundoplication, reflux study, swallow study, upper gastrointestinal series, histamine antagonist, proton pump inhibitor, and promotility agent.

[b] Median HHI based on zip code of residence, reported in quartiles.

[c] CCC categories identified by using ICD-9-CM codes as defined by Feudtner et al.[17]

[d] Covariables identified by using ICD-9-CM codes as defined in Supplemental Table 4.

[e] Oral feeding defined as all those patients not having codes consistent with either G/J or NG/NJ codes.

preplacement and postplacement periods. Gastrostomy tube placement has been shown to improve oral intake, decrease vomiting, and improve growth compared with NG tubes.[32–34] Early (<18 months of age) tube placement, compared with later gastrostomy tube placement, improves growth and anthropometric variables for children with impaired feeding abilities.[32,34] However, details regarding feeding modalities (eg, mixed modality feeding) could not be fully delineated in the present study. For instance, what type of oral feeds were delivered or when medically provided nutrition was initiated or advanced from 1 modality to another could not be specified, only that it was delivered during the index hospitalization (ie, the discharge feeding plan could not be determined). Furthermore, slightly more than one-half of the children readmitted who had previously received NG/NJ feedings during their index admission received a new gastrostomy tube during their readmission. This scenario possibly suggests that some readmissions among children receiving NG/NJ feedings may have been planned. Regardless, this high rate of subsequent gastrostomy placement represents additional FTT-related resource utilization. Due to these limitations, it remains unclear if our findings suggest that for select populations, gastrostomy tubes compared with nasogastric tubes would prevent FTT-specific readmissions. In addition, any reduction in readmission rates and other potential benefits of earlier gastrostomy placement would need to be weighed against their costs and potential complications.

Concern for child maltreatment is one situation warranting hospitalization.[35] However, concurrent coding for child abuse or neglect in the present study's cohort was rare. Although our findings of maltreatment were low, they are aligned with earlier evidence suggesting that neglect is a vastly minor contributor in the etiology of FTT, with clinicians having a tendency to both clinically overestimate its role while simultaneously underreporting its involvement when present.[28,36–38] In addition, some diagnostic and treatment variables such as brain MRI and acid

suppression medications were associated with readmission. Although these interventions by themselves may or may not incur risk, their utilization might represent a perceived level of disease severity that could alert clinicians to readmission risk.

There are limitations to the present study that must be considered when interpreting the results. This study is subject to limitations inherent to retrospective administrative database research. Most importantly, some children admitted for FTT may have been coded for an underlying etiology identified during their index hospitalization and not received a primary discharge code for FTT itself, and therefore would not have been included in the study cohort. However, inclusion of only those children receiving primary FTT discharge codes for both the index hospitalization and the readmission worked to minimize unrelated hospitalizations and readmissions. The counterintuitive finding in this study that with an increasing number of CCCs, the risk for FTT-specific readmission decreased is in contrast to previously reported data.[6,7] This outcome is presumed not to be due to true resolution of growth failure but is a manifestation of coding limitations as well as possible permissive weight faltering in the face of medical complexity. The etiology of FTT is often multifactorial, with contributions from multiple concurrent medical conditions as well as diverse psychosocial and socioeconomic factors that cannot be captured in database research. We also could not account for outpatient services and therapies that may have been provided both prehospitalization and posthospitalization, an important aspect in the treatment of FTT. The PHIS database only allows tracking of readmissions to the same PHIS hospital and, therefore, readmissions to a different hospital would have not been captured. Our study cohort was from freestanding children's hospitals, which care for a higher proportion of children with medical complexity and may not be generalizable to all clinical settings.[7] Finally, although it has been previously used, approximation of patient-level income according to zip code level must be interpreted with caution because the macrolevel estimation may not accurately represent all individuals living in a specific zip code.[12,39]

The present study also has a number of strengths. The use of the PHIS database allowed for a large and diverse (clinically and geographically) cohort of children hospitalized with FTT. The 3-year window to assess for the distribution of time to readmission, while atypical, enabled detection of a uniquely delayed median time-to-readmission that otherwise would have gone undetected. Use of the CCC coding system to identify medical complexity provided a current descriptive assessment of children hospitalized with FTT and further validated the burden of refractory growth failure among premature infants. Finally, statistical modeling allowed for the identification of unique predictors for FTT-specific readmission.

CONCLUSIONS

Nearly one-half of children hospitalized for FTT have a CCC, and a majority of FTT-specific readmissions occur after the traditional 30-day window. FTT treatment protocols, research, and quality improvement initiatives should account for these findings. In contrast to previous evidence, low income was associated with FTT-specific readmission in the present study. Psychosocial and socioeconomic assessments with targeted assistance for children admitted with FTT should be routine. Prematurity-related CCC was associated with readmission, further validating premature infants' risk for growth failure and need for unique interventions, not only during their neonatal intensive care courses, but throughout infancy and with FTT hospitalizations. Future study is required to delineate what, if any, association feeding modality may have with FTT readmission risk.

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Hospital Pediatrics 2016;6;468
DOI: 10.1542/hpeds.2015-0248 originally published online July 20, 2016;

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